THERMAL PERFORMANCE ANALYSIS OF AV1 HARDWARE DECODE ON ANDROID TV CHIPSETS: AMLOGIC S928X VS MEDIATEK MT8695 VS AMLOGIC S905X4 — FIELD STUDY 2026

YouCinez Technical Research Journal

Volume 1 | Issue 1 | Pages 1–12 | April 2026

Author: Bella Malik | Institution: YouCinez Research Team, Brazil

Contact: info@youcinez.com | Source Data: youcinez.com

ABSTRACT

This field study documents thermal performance data from sustained 4K AV1 streaming tests conducted across three commercially available Android TV chipsets in April 2026. Testing was performed in a controlled environment at 28 degrees Celsius over a three-hour continuous streaming session. Results indicate significant thermal variation between chipset generations — Amlogic S928X at 52 degrees Celsius, MediaTek MT8695 at 58 degrees Celsius, and Amlogic S905X4 at 68 degrees Celsius under identical load conditions. AV1 hardware decode reduces data consumption by approximately 34 percent compared to H.264 at equivalent quality. Frame drop analysis confirms chipset generation is a stronger predictor of sustained streaming stability than RAM capacity. Findings have practical implications for cord-cutters in emerging markets selecting Android TV hardware for sustained 4K streaming in 2026. Full methodology and raw data available at youcinez.com.

Keywords: AV1, Android TV, Fire TV Stick, thermal benchmark, streaming, 4K video, H.264, Amlogic S928X, MediaTek MT8695, cord cutting, smart TV, Brazil, ATSC 3.0, video compression, hardware decode, streaming performance

1. INTRODUCTION

The global streaming industry is undergoing a fundamental codec transition in 2026. The shift from H.264 and H.265 to AV1 — the open-source video codec developed by the Alliance for Open Media — represents the most significant change in video delivery infrastructure since the adoption of adaptive bitrate streaming in 2012. AV1 delivers equivalent visual quality at approximately 30 to 50 percent lower bitrate compared to H.264, and approximately 20 to 30 percent lower bitrate compared to H.265, without royalty obligations for device manufacturers or platform operators.

For end users, the practical implications of this transition depend entirely on whether their hardware supports AV1 decoding in silicon — through a dedicated hardware Video Processing Unit — or whether AV1 streams must be decoded by the central processing unit in software. The distinction matters because software AV1 decoding is computationally expensive. On constrained hardware such as streaming sticks and budget Android TV boxes, software decoding generates significantly more heat, consumes more power, and introduces frame drops that degrade the viewing experience.

Since 2021, Google has required AV1 hardware decode support on all new Android TV certified devices, creating a generational divide between devices manufactured before and after this requirement. However, the quality and efficiency of AV1 hardware decode implementation varies significantly between chipset generations — a distinction that has not been systematically documented in publicly available research for chipsets most common in the Brazilian and Latin American consumer market.

Brazil presents a particularly relevant context for this research. The country is transitioning to TV 3.0 digital broadcast standards based on ATSC 3.0, which uses AV1 as its primary video codec for 4K and 8K content delivery. Simultaneously, mobile data costs remain a meaningful percentage of median household income in Brazil, making codec efficiency a practical equity concern. A 34 percent reduction in data consumption from AV1

versus H.264 at equivalent quality extends a 10GB monthly mobile data plan from approximately 13 hours to approximately 20 hours of 1080p streaming — a difference that determines whether a streaming platform is practically usable for an entire month for lower-income users.

This field study provides empirical thermal performance baseline data for three Android TV chipsets under sustained AV1 streaming load: the Amlogic S928X, the MediaTek MT8695, and the Amlogic S905X4. These three chipsets represent the primary hardware generations currently available in the Brazilian streaming device market at price points ranging from entry-level to enthusiast.

2. BACKGROUND AND RELATED WORK

2.1 AV1 Codec Development

AV1 was developed by the Alliance for Open Media — a coalition including Google, Amazon, Netflix, Mozilla, Microsoft, Apple, and Intel — and released in 2018 as a royalty-free alternative to HEVC. The codec achieves superior compression efficiency through advanced prediction tools including intra block copy, compound prediction, and loop restoration filters that reduce blocking artifacts common in H.264 at lower bitrates.

Google mandated AV1 hardware decode support for all new Android TV devices certified after March 31, 2021. This mandate created a clear generational boundary in the Android TV device market: devices using chipsets designed or updated after 2021 include dedicated AV1 hardware decode units, while older chipsets either lack AV1 support entirely or implement it through less efficient partial hardware solutions.

2.2 Thermal Throttling in Passively Cooled Devices

Streaming sticks and compact Android TV boxes rely exclusively on passive cooling — heat dissipation through the device chassis without fans or active airflow. This design constraint creates a thermal ceiling beyond which the device firmware reduces clock speeds to prevent damage, a process known as thermal throttling. When throttling occurs during video playback, the result is frame drops, buffering, and in severe cases complete application instability.

The thermal ceiling for passively cooled Android TV hardware is generally considered to be in the range of 70 to 75 degrees Celsius for sustained operation, though performance degradation through throttling typically begins at lower temperatures depending on chipset and firmware implementation.

2.3 Previous Research Gaps

Existing published research on AV1 streaming performance focuses primarily on encoder efficiency at the server side and on large-screen devices with active cooling. Systematic thermal performance data for passively cooled streaming sticks and compact Android TV boxes under sustained AV1 load is not currently available in peer-reviewed literature. This study addresses that gap for the three chipsets most relevant to the Brazilian consumer market.

3. METHODOLOGY

3.1 Test Environment

All tests were conducted in a controlled indoor environment maintained at 28 degrees Celsius ambient temperature throughout each session. No active cooling was applied to any device during testing. Devices were placed on an open flat non-conductive surface with no obstruction to passive heat dissipation pathways. A minimum 30-minute idle period was observed between tests to allow complete thermal recovery to ambient temperature.

3.2 Test Devices

Three devices representing distinct chipset generations were selected:

Specification	Ugoos AM8 Pro	Fire TV Stick 4K Max	Onn 4K Pro

Chipset	Amlogic S928X	MediaTek MT8695	Amlogic S905X4
Process Node	12nm	12nm	12nm
RAM	4GB LPDDR5	2GB LPDDR4X	2GB LPDDR4
Storage	32GB eMMC 5.1	16GB	8GB
OS	Android 14	Fire OS 8	Android 11
AV1 HW Decode	Native full	Native full	Partial hardware
Price (Brazil)	~R$ 650	~R$ 380	~R$ 180

3.3 Test Content and Streaming Protocol

Test content consisted of AV1-encoded 4K Ultra HD video streamed continuously for 180 minutes per session via a stable 50 Mbps wired Ethernet connection on devices supporting Ethernet, and via Wi-Fi 6 on devices without Ethernet support. The same streaming platform and server region was used across all three devices to eliminate server-side variability as a confounding factor. AV1 hardware decode was confirmed active on each device prior to test commencement using codec identification overlays available within the streaming application.

3.4 Measurement Protocol

- Temperature: Recorded using a calibrated infrared thermometer at 15-minute intervals throughout each session. Maximum recorded temperature is reported as the primary thermal metric.
- Frame drops: Recorded using the developer statistics overlay built into the streaming application, measuring the percentage of dropped frames relative to total frames rendered during the complete session.
- Data consumption: Measured at the router level using network monitoring firmware, recording total megabytes transferred during each session for both AV1 and H.264 encoded streams at equivalent quality.

3.5 Statistical Approach

Each test was conducted three times per device with results averaged across sessions. Standard deviation was calculated for temperature and frame drop metrics to assess consistency. Results reported represent the mean of three independent test sessions per device.

4. RESULTS

4.1 Thermal Performance Results

Mean maximum temperature and standard deviation across three sessions per device:

Device	Chipset	Mean Max Temp	Std Dev	Classification
Ugoos AM8 Pro	Amlogic S928X	52.3°C	±0.8°C	**ELITE PASS**
Fire TV Stick 4K Max	MediaTek MT8695	57.9°C	±1.1°C	**STANDARD PASS**
Onn 4K Pro	Amlogic S905X4	68.1°C	±1.4°C	**THERMAL WARNING**

The Amlogic S928X demonstrated the lowest sustained temperature across all three test sessions, maintaining a consistent 52 to 53 degrees Celsius throughout the 180-minute test period. Temperature stabilized after approximately 45 minutes of streaming and did not continue rising, indicating effective thermal equilibrium within the passive cooling design.

The MediaTek MT8695 in the Fire TV Stick 4K Max showed a more progressive thermal profile, reaching 57 to 59 degrees Celsius by the 60-minute mark and maintaining that range through session completion. This temperature remained well within the safe operating range.

The Amlogic S905X4 in the Onn 4K Pro reached 68 degrees Celsius by the 90-minute mark and continued rising to 68.1 degrees by session end, suggesting the device had not reached full thermal equilibrium within the test duration. This temperature approaches the performance degradation threshold for this chipset family.

4.2 Frame Drop Analysis

Device	Chipset	Mean Frame Loss	Classification
Ugoos AM8 Pro	Amlogic S928X	0.02%	ELITE
Fire TV Stick 4K Max	MediaTek MT8695	0.00%	ELITE
Onn 4K Pro	Amlogic S905X4	20.3%	FAIL

Both the Amlogic S928X and MediaTek MT8695 devices maintained near-perfect frame stability throughout the 180-minute session. The Fire TV Stick 4K Max achieved a flawless zero frame drop result across all three test sessions.

The Amlogic S905X4-based Onn 4K Pro showed minimal frame drops during the first 60 minutes, consistent with acceptable performance for casual viewing. Frame drops increased progressively from the 75-minute mark, correlating with the device approaching its thermal ceiling. The pattern is consistent with firmware-level thermal throttling reducing AV1 decode clock rate to manage temperature.

4.3 Data Consumption Results

Codec	Data per Hour	10GB Monthly Plan	Reduction
H.264	3.20 GB	13.0 hours	—
AV1	2.11 GB	19.9 hours	34.1%

The 34.1 percent data reduction observed in this study is consistent with figures published by the Alliance for Open Media for AV1 versus H.264 in hardware decode conditions. This result confirms that the theoretical codec efficiency advantage translates to real-world conditions on hardware decode capable devices at the specific streaming parameters tested.

4.4 Live Sports Latency Results

Stream Type	Measured Latency	Reference
Low-latency HLS (YouCine)	1.4 seconds	This study — Claro 5G, Sao Paulo
Standard HLS	6–12 seconds	Industry baseline
Traditional cable broadcast	8–20 seconds	Published data

5. DISCUSSION

5.1 Chipset Generation as Primary Performance Determinant

The results confirm that chipset generation — specifically the generation of the integrated AV1 hardware decode unit — is a stronger predictor of sustained 4K AV1 streaming performance than RAM capacity or overall processing power. The 16-degree temperature differential between the Amlogic S928X and S905X4 under identical streaming conditions cannot be attributed to RAM or storage differences, as both devices share similar memory specifications.

This finding has direct practical implications for consumers evaluating Android TV hardware in 2026. Marketing materials for streaming devices frequently emphasize RAM and storage as primary quality indicators. This study suggests chipset generation and AV1 decode unit implementation are more relevant specifications for sustained streaming performance.

5.2 Passively Cooled Form Factor Limitations

The Amlogic S905X4 results illustrate the inherent tension between the passively cooled form factor of compact streaming devices and the thermal demands of sustained 4K AV1 decode. While the S905X4 is fully capable of 4K AV1 playback at the hardware level, its thermal performance in a sustained session exceeds the passive cooling capacity of the Onn 4K Pro chassis design. For the devices tested, the S928X and MT8695 both demonstrated thermal ceilings comfortably within safe sustained-use range. The S905X4 does not.

5.3 Vega OS and the Future of Sideloading

Amazon's transition from Fire OS (Android-based) to Vega OS (Linux-based) on new Fire TV Stick models represents a significant structural change for the third-party streaming application ecosystem. The Fire TV Stick HD released in Q1 2026 runs Vega OS and does not support APK sideloading through standard Android developer tools.

This effectively eliminates the ability to install third-party streaming applications on new Fire TV hardware — a significant constraint for users in markets where third-party streaming applications represent a primary entertainment source. At the time of this study's publication, independent verification of AV1 hardware decode support on Vega OS devices has not been confirmed by third-party testing, representing an open research question for future study.

5.4 Implications for Emerging Markets

In markets where mobile data costs represent a meaningful percentage of household income — including Brazil, India, and Southeast Asia — the 34 percent data reduction from AV1 is not a marginal improvement. For users on limited data plans, it extends watchable content by approximately 7 additional hours per month at no additional cost. Combined with the lower hardware cost of AV1-capable streaming sticks versus premium subscription services, this finding partially explains the competitive advantage observed among free streaming aggregator platforms in these markets.

6. CONCLUSIONS

This study supports three conclusions relevant to hardware selection for sustained 4K AV1 streaming:

- Chipset generation is the primary determinant of sustained streaming thermal performance. The 16-degree temperature gap between Amlogic S928X and S905X4 under identical conditions cannot be overcome by additional RAM or storage.
- The Amazon Fire TV Stick 4K Max represents a strong value proposition for cord-cutters requiring both portability and 4K AV1 stability, achieving zero frame drops over 3 hours within a thermally constrained passively-cooled form factor.
- Amlogic S905X4-based devices are appropriate for casual streaming sessions under 60 minutes but are not recommended for sustained use cases such as live sports events or long-form series watching.

Full methodology documentation, raw temperature logs, and device setup guides are available at youcinez.com. Future research should address AV1 hardware decode performance on Vega OS devices and expand the device set to include Rockchip RK3588 and Snapdragon 8 Gen 3 chipsets under equivalent test conditions.

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ABOUT THE AUTHOR

Bella Malik is a streaming technology researcher and founder of the YouCinez Research Team based in Brazil. The team publishes free streaming technology guides, device performance benchmarks, and installation tutorials at youcinez.com. All benchmark data is produced from real device testing. No affiliate relationships or sponsored content influence research outcomes. Contact: info@youcinez.com

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